

## CLAIMS

1. A standard model creating apparatus for creating a standard model which shows an acoustic characteristic having a specific attribute and is used for speech recognition, using a probability model that expresses a frequency parameter showing an acoustic characteristic as an output probability, said standard model creating apparatus comprising:
  - 5 a reference model storing unit operable to store at least one reference model which is a probability model showing an acoustic characteristic having a specific attribute; and
  - 10 a standard model creating unit operable to create the standard model by calculating statistics of the standard model using statistics of the at least one reference model stored in said reference model storing unit,
- 15 wherein said standard model creating unit is operable to include:
  - 1 a standard model structure determining unit operable to determine a structure of the standard model which is to be created;
- 20 an initial standard model creating unit operable to determine initial values of the statistics specifying the standard model whose structure has been determined; and
- 25 a statistics estimating unit operable to estimate and calculate the statistics of the standard model so as to maximize or locally maximize a probability or a likelihood of the standard model, whose initial values have been determined, with respect to the reference model.

  

2. The standard model creating apparatus according to Claim 1,
- 30 further comprising
  - 1 a reference model selecting unit operable to select at least one reference model from among the at least one reference model

stored in said reference model storing unit, on the basis of usage information regarding an attribute which is an object of speech recognition,

wherein said standard model creating unit is operable to

5 create the standard model using statistics of the reference model selected by said reference model selecting unit.

3. The standard model creating apparatus according to Claim 2, further comprising

10 a usage information creating unit operable to create the usage information,

wherein said reference selecting unit is operable to select at least one reference model from among the at least one reference model stored in said reference model storing unit, on the basis of 15 the created usage information.

4. The standard model creating apparatus according to Claim 2, being connected to a terminal apparatus via a communication channel, further comprising

20 a usage information receiving unit operable to receive the usage information from said terminal apparatus,

wherein said reference model selecting unit is operable to select at least one reference model from among the at least one reference model stored in said reference model storing unit, on the 25 basis of the received usage information.

5. The standard model creating apparatus for speech recognition according to Claim 1,

wherein said standard model structure determining unit is

30 operable to determine the structure of the standard model, on the basis of at least one of: specification information regarding specifications of the standard model which is to be created; and

usage information regarding an attribute which is an object of speech recognition.

6. The standard model creating apparatus for speech  
5 recognition according to Claim 5,

wherein the specification information is operable to show at least one of: a type of an application program which uses the standard model; and specifications of an apparatus which uses the standard model.

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7. The standard model creating apparatus for speech recognition according to Claim 5,

wherein the attribute includes information regarding at least one of: an age; a gender; a texture of a speaker's voice; a tone of voice changed with emotions or health condition; a speaking rate; civility in utterance; a dialect; a type of background noise; loudness of background noise; an S/N ratio between speech and background noise; a microphone quality; and a degree of complexity in recognizable vocabulary.

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8. The standard model creating apparatus according to Claim 5 further comprising

a specification information holding unit operable to hold an application/specifications correspondence database showing a correspondence between an application program which uses the standard model and specifications of the standard model,

wherein said standard model structure determining unit is operable to read specifications corresponding to an application program to be activated from the application/specifications correspondence database held by said specification information holding unit, and to determine the structure of the standard model on the basis of the read specifications.

9. The standard model creating apparatus according to Claim 5 further comprising

a specification information creating unit operable to create

5 the specification information,

wherein said standard model structure determining unit is operable to determine the structure of the standard model on the basis of the created specification information.

10 10. The standard model creating apparatus according to Claim 5, being connected to a terminal apparatus via a communication channel, further comprising

a specification information receiving unit operable to receive the specification information from said terminal apparatus,

15 wherein said standard model structure determining unit is operable to determine the structure of the standard model on the basis of the received specification information.

11. The standard model creating apparatus according to Claim 20 5,

wherein each of the reference model and the standard model is expressed using at least one Gaussian distribution, and

25 said standard model structure determining unit is operable to determine at least the number of Gaussian mixture distributions as the structure of the standard model.

12. The standard model creating apparatus according to Claim 1, being connected to a terminal apparatus via a communication channel, further comprising

30 a standard model transmitting unit operable to transmit the standard model created by said standard model creating unit to said terminal apparatus.

13. The standard model creating apparatus according to Claim 1,

wherein each of the reference model and the standard model

5 is expressed using at least one Gaussian distribution,

said reference model storing unit is operable to store a pair of reference models, each having at least a different number of Gaussian mixture distributions, and

10 said statistics estimating unit is operable to calculate the statistics of the standard model so as to maximize or locally maximize a probability or a likelihood of the standard model with respect to the pair of reference models.

14. The standard model creating apparatus according to Claim 1,

15 wherein said standard model creating unit is further operable to include

20 a reference model preparing unit operable to at least one of: obtain a reference model from an outside source and store the obtained reference model into said reference model storing unit; and create a new reference model and store the new reference model into said reference model storing unit.

15. The standard model creating apparatus according to Claim 14,

25 wherein said reference model preparing unit is further operable to perform at least one of an update and an addition to the reference model stored in said reference model storing unit.

30 16. The standard model creating apparatus according to Claim 15,

wherein said reference model preparing unit is operable to

perform at least one of an update and an addition to the reference model stored in said reference model storing unit, on the basis of at least one of: usage information regarding an object of recognition; and specification information regarding specifications of the 5 standard model which is to be created.

17. The standard model creating apparatus according to Claim 15 further comprising

a similarity information creating unit operable to create,

10 on the basis of the reference model stored in said reference model storing unit and at least one of: specification information regarding specifications of the standard model which is to be created; and usage information regarding an attribute which is an object of speech recognition,

15 similarity information showing a degree of similarity to the reference model and at least one of the usage information and the specification information,

wherein said reference model preparing unit is operable to determine whether or not to perform at least one of an update and 20 an addition to the reference model stored in said reference model storing unit, on the basis of the similarity information created by said similarity information creating unit.

18. The standard model creating apparatus according to Claim 25 1,

wherein said initial standard model creating unit is operable to determine the initial values of the statistics specifying the standard model using the at least one reference model which is used by said statistics estimating unit for calculating the statistics 30 of the standard model.

19. The standard model creating apparatus according to Claim

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wherein said initial standard model creating unit is operable to determine the initial values on the basis of a class ID that identifies a type of the standard model.

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20. The standard model creating apparatus according to Claim 19,

wherein said initial standard model creating unit is operable to specify the class ID from the reference model and to determine 10 initial values associated with the specified ID as the initial values.

21. The standard model creating apparatus according to Claim 20,

wherein said initial standard model creating unit is operable 15 to hold a correspondence table showing a correspondence among the class ID, the initial values, and the reference model, and to determine the initial values in accordance with the correspondence table.

20 22. The standard model creating apparatus according to Claim 21,

wherein said initial standard model creating unit is operable to generate the correspondence table by creating, or by obtaining 25 from an outside source, an initial standard model with a class ID, that is, initial values associated with the class ID, or a reference model with a class ID, that is, a reference model associated with the class ID.

23. The standard model creating apparatus according to Claim 30 1,

wherein said reference model storing unit is operable to store a plurality of reference models, and

said statistics estimating unit is operable to calculate the statistics so as to maximize or locally maximize the probability or the likelihood weighted with respect to the plurality of reference models stored in said reference model storing unit.

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24. A method of creating a standard model which shows an acoustic characteristic having a specific attribute and is used for speech recognition, using a probability model that expresses a frequency parameter showing an acoustic characteristic as an output probability, said method comprising:

10       a reference model reading step of reading at least one reference model from a reference model storing unit which is operable to store at least one reference model that is a probability model showing an acoustic characteristic having a specific attribute; and

15       a standard model creating step of creating the standard model by calculating statistics of the standard model using statistics of the read reference model,

20       wherein said standard model creating step includes:

25       a standard model structure determining sub-step of determining a structure of the standard model which is to be created;

30       an initial standard model creating sub-step of determining initial values of the statistics specifying the standard model whose structure has been determined; and

35       a statistics estimating sub-step of estimating and calculating the statistics of the standard model so as to maximize or locally maximize a probability or a likelihood of the standard model, whose initial values have been determined, with respect to the reference model.

25. A program for a standard model creating apparatus which

creates a standard model that shows an acoustic characteristic having a specific attribute and that is used for speech recognition, using a probability model that expresses a frequency parameter showing an acoustic characteristic as an output probability, said

5 program comprising:

a reference model reading step of reading at least one reference model from a reference model storing unit which is operable to store at least one reference model that is a probability model showing an acoustic characteristic having a specific

10 attribute; and

a standard model creating step of creating the standard model by calculating statistics of the standard model using statistics of the read reference model,

wherein said standard model creating step includes:

15 a standard model structure determining sub-step of determining a structure of the standard model which is to be created;

20 an initial standard model creating sub-step of determining initial values of the statistics specifying the standard model whose structure has been determined; and

25 a statistics estimating sub-step of estimating and calculating the statistics of the standard model so as to maximize or locally maximize a probability or a likelihood of the standard model, whose initial values have been determined, with respect to the reference model.